



Complete Summary

GUIDELINE TITLE

Practice management guidelines for management of penetrating trauma to the lower extremity.

BIBLIOGRAPHIC SOURCE(S)

EAST Practice Management Guidelines Work Group. Practice management guidelines for the management of penetrating trauma to the lower extremity. Winston-Salem (NC): Eastern Association for the Surgery of Trauma (EAST); 1999. 35 p. [74 references]

COMPLETE SUMMARY CONTENT

SCOPE

METHODOLOGY - including Rating Scheme and Cost Analysis

RECOMMENDATIONS

EVIDENCE SUPPORTING THE RECOMMENDATIONS

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

IMPLEMENTATION OF THE GUIDELINE

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT

CATEGORIES

IDENTIFYING INFORMATION AND AVAILABILITY

SCOPE

DISEASE/CONDITION(S)

- Lower extremity venous injuries from penetrating trauma
- Lower extremity isolated arterial injuries from penetrating trauma
- Combined arterial and skeletal extremity injury from penetrating trauma

GUIDELINE CATEGORY

Diagnosis

Evaluation

Management

CLINICAL SPECIALTY

Emergency Medicine

Orthopedic Surgery

Surgery

INTENDED USERS

Advanced Practice Nurses
Allied Health Personnel
Nurses
Physician Assistants
Physicians

GUIDELINE OBJECTIVE(S)

To present recommendations for evaluation and management of vascular and skeletal injuries resulting from penetrating trauma, including:

- Lower extremity venous injuries
- Lower extremity isolated arterial injuries
- Combined arterial and skeletal injuries

TARGET POPULATION

Patients with penetrating trauma to the lower extremities

INTERVENTIONS AND PRACTICES CONSIDERED

Lower Extremity Venous Injuries

1. Lateral venorrhaphy
2. Interposition vein grafts
3. Synthetic grafts
4. Venous ligation in conjunction with leg elevation, compression stockings, and liberal use of fasciotomies
5. Use of adjunctive measures such as creation of an arteriovenous fistula and anticoagulants (considered but not recommended)

Lower Extremity Arterial Injuries

1. Evaluation of hard signs of arterial injury (pulse deficit, pulsatile bleeding, bruit, thrill, expanding hematoma)
2. Surgical exploration without arteriogram
3. Simple repair of arteries by end-to-end anastomosis or arteriography
4. Complex repair with use of vein grafts or polytetrafluoroethylene (PTFE) grafts
5. Use of preoperative arteriography
6. Doppler pressure monitoring
7. Duplex ultrasonography
8. Nonoperative observation
9. Ligation of tibial vessels
10. Early four-compartment lower leg fasciotomy
11. Monitoring of compartment pressures
12. Completion arteriography

Combined Arterial and Skeletal Extremity Injuries

1. Orthopedic consultation for assessment and management decisions

2. Preoperative arteriography
3. Restoration of blood flow by temporary shunting or immediate definitive arterial repair
4. Completion arteriography to confirm arterial patency
5. Doppler pressure monitoring
6. Duplex ultrasonography
7. Nonoperative observation
8. Four-compartment fasciotomy
9. External fixation versus internal fixation for skeletal repair
10. Primary amputation
11. Use of scoring systems for predicting need for amputation

MAJOR OUTCOMES CONSIDERED

Lower Extremity Venous Injuries

- Incidence of edema
- Patency of venous repairs
- Incidence of thrombosis
- Incidence of limb loss (amputation)
- Length of hospital stay
- Incidence of short-term and long-term sequelae

Lower Extremity Arterial Injuries

- Limb salvage rate (amputation rate)
- Patency rates
- False-positive/false-negative rates on arteriograms
- Sensitivity and specificity of duplex ultrasonography

Combined Arterial and Skeletal Extremity Injuries

- Limb salvage rate (amputation rate)
- Sensitivity and specificity of scoring systems for limb salvage (limb salvage index)

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Hand-searches of Published Literature (Secondary Sources)
 Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

Lower Extremity Venous Injuries

A Medline computer search was conducted on all articles in the English literature during the years 1980-1997 pertaining to venous injuries of the lower extremity. The subject words used included "vascular injury," "venous injury," "extremity

trauma," "penetrating trauma," "vascular trauma," and "venous trauma." The references of these articles were also used to locate articles not found in the Medline search. Personal files were also used. All letters to the editor, case reports, book chapters, review articles, series involving less than 20 cases, series involving predominantly blunt trauma, and series in which the percentage and outcome of the penetrating injuries were not clearly specified were excluded. Also articles whose focus was the management of arterial injuries but also included the results of their venous injuries were excluded. This left 14 articles of relevance to this practice parameter.

Lower Extremity Arterial Injuries

A Medline computer search was conducted on all articles in the English Literature during the years 1980-1997 pertaining to arterial injuries of the lower extremity. The subject words used included "vascular injury," "artery injury," "extremity trauma," "penetrating trauma," "vascular trauma," and "artery trauma." The references of these articles were also used to locate articles not found in the Medline search. Personal files were also used. All letters to the editor, case reports, book chapters, review articles, series involving less than 20 cases, and series in which the percentage and outcome of the penetrating injuries were not clearly specified were excluded. This left 36 articles of relevance to this practice parameter. In addition there were 2 abstracts that were relevant to this practice parameter.

Combined Arterial and Skeletal Extremity Injury

A Medline computer search was conducted on all articles in the English Literature during the years 1980-1997 pertaining to arterial injuries of the lower extremity in combination with skeletal injuries. The subject words used included "vascular injury," "artery injury," "extremity trauma," "penetrating trauma," "vascular trauma," "extremity fracture," "extremity dislocation," and "artery trauma." The references of these articles were also used to locate articles not found in the Medline search. Personal files were also used. All letters to the editor, case reports, book chapters, review articles, series involving less than 20 cases, series involving predominantly blunt trauma, and series in which the percentage and outcome of the penetrating injuries were not clearly specified were excluded. This left 25 articles of relevance to this practice parameter.

NUMBER OF SOURCE DOCUMENTS

Lower Extremity Venous Injuries: 14

Lower Extremity Arterial Injuries: 38

Combined Arterial and Skeletal Extremity Injury: 25

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Evidence Classification Scheme:

Class I: Prospective, Randomized, Double-Blinded Study

Class II: Prospective, Randomized, Non-Blinded Trial

Class III: Retrospective Analysis of Patient Series

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not applicable

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Not stated

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Level I: The recommendation is convincingly justifiable based on the available scientific information alone. This recommendation is usually based on Class I data, however, strong Class II evidence may form the basis for a Level I recommendation, especially if the issue does not lend itself to testing in a randomized format. Conversely, low quality or contradictory Class I data may not be able to support a Level I recommendation.

Level II: The recommendation is reasonably justifiable by available scientific evidence and strongly supported by expert opinion. This recommendation is usually supported by Class II data or a preponderance of Class III evidence.

Level III: The recommendation is supported by available data but adequate scientific evidence is lacking. This recommendation is generally supported by Class III data. This type of recommendation is useful for educational purposes and in guiding future clinical research.

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

The draft document is submitted to all members of the panel for review and modification. Subsequently the guidelines are forwarded to the chairmen of the Eastern Association of Trauma ad hoc committee for guideline development. Final modifications are made and the document is forwarded back to the individual panel chairpersons.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Level I-III recommendations and the class of data grading (I-III) are defined at the end of the "Major Recommendations" field.

Lower Extremity Venous Injuries from Penetrating Trauma

A. Level 1 Recommendations

There is no Class I evidence to support a standard of care for this parameter.

B. Level 2 Recommendations

There is no Class II evidence to support a standard of care for this parameter.

C. Level 3 Recommendations

1. There is insufficient data to recommend treatment for isolated venous injuries. Isolated venous injuries accompanied with active hemorrhage require exploration and cessation of bleeding.
2. Venous injuries found during exploration for associated arterial injury should be repaired if the patient is hemodynamically stable and the repair itself will not significantly delay treatment of associated injuries or destabilize the patient's condition.
3. Lateral venorrhaphy that does not significantly narrow the lumen or paneled grafts appear to be the best options for repair. Interposition vein grafts consistently have poor results, and synthetic grafts are the least desirable option for repair.
4. There is insufficient data to recommend adjunctive measures to improve vein repair patency.
5. Venous ligation in conjunction with leg elevation, compression stockings, and liberal use of fasciotomies offers similar results to repair.
6. Fasciotomy should be considered when there is a combined arterial and venous injury.

Lower Extremity Isolated Arterial Injuries from Penetrating Trauma

A. Level 1 Recommendations

There is no Class I evidence to support a standard of care for this parameter.

B. Level 2 Recommendations

1. Patients with hard signs of arterial injury (pulse deficit, pulsatile bleeding, bruit, thrill, expanding hematoma) should be surgically explored. There is no need for arteriogram in this setting, unless the patient has an associated skeletal injury or a shotgun injury.
 2. Restoration of perfusion to an extremity with an arterial injury should be performed in less than six hours in order to maximize limb salvage.
- C. Level 3 Recommendations
1. There is no defined role for the use of noninvasive Doppler pressure monitoring or duplex ultrasonography to confirm or exclude arterial injury. There may be a role for these studies in patients with soft signs of vascular injury or with proximity injuries.
 2. Absence of hard or soft signs of vascular injury reliably excludes surgically significant arterial injury and does not require arteriography.
 3. Nonoperative observation of asymptomatic nonocclusive arterial injuries is acceptable.
 4. Repair of occult and asymptomatic nonocclusive arterial injuries managed nonoperatively that subsequently require repair can be done without significant increase in morbidity.
 5. Simple arterial repairs fare better than grafts. If complex repair is required, vein grafts appear to be the best choice. Polytetrafluoroethylene (PTFE), however, is also an acceptable conduit.
 6. Polytetrafluoroethylene may be used in a contaminated field. Effort should be made to obtain soft tissue coverage.
 7. Tibial vessels may be ligated if there is documented flow distally.
 8. Early four-compartment lower leg fasciotomy should be applied liberally when there is an associated injury or there has been prolonged ischemia. If not performed, compartment pressures should be closely monitored.
 9. Arteriography for proximity is indicated only in patients with shotgun injuries.
 10. Completion arteriogram should be performed after arterial repair.

Combined Arterial and Skeletal Extremity Injury from Penetrating Trauma

A. Level 1 Recommendations

There is no Class I evidence to support a standard of care for this parameter.

B. Level 2 Recommendations

1. The interval between injury and reperfusion should be minimized to less than six hours in order to maximize limb salvage.
2. Restoration of blood flow should always take priority over skeletal injury management, either by temporary shunting to allow stabilization of unstable fractures and/or dislocations prior to definitive arterial repair, or by immediate definitive arterial repair when the skeletal injury is stable and not significantly displaced.

C. Level 3 Recommendations

1. Orthopedic surgeons should be involved immediately in assessment and management decisions.
2. Arteriography should be done promptly when hard signs of vascular injury are manifest.

3. There is no defined role for the use of noninvasive Doppler pressure monitoring or duplex ultrasonography to confirm or exclude arterial injury in this setting.
4. Evidence suggests that an absence of hard signs of vascular injury in this setting reliably excludes surgically significant arterial injury, and does not require arteriography.
5. Nonoperative observation of asymptomatic nonocclusive arterial injuries may be considered.
6. Four-compartment fasciotomy should be liberally applied at the time of arterial and skeletal repair. If not done compartment pressures should be monitored closely.
7. Completion arteriography should be performed.
8. External fixation is preferable for the immediate management of unstable, displaced, comminuted and open fractures or dislocations. This is especially important in those with severe contamination, extensive soft tissue injury, or in an unstable patient.
9. Primary amputation should be considered in those with tibial or sciatic nerve transection, prolonged ischemia, massive soft tissue injury, severe contamination, open comminuted tibial-fibular fractures (Gustilo-III), or life-threatening associated injuries.
10. Mangled extremity scoring systems are not sufficiently reliable to serve as the sole determinant of extremity amputation.

Definitions:

Recommendation Scheme:

Level I: The recommendation is convincingly justifiable based on the available scientific information alone. This recommendation is usually based on Class I data, however, strong Class II evidence may form the basis for a Level I recommendation, especially if the issue does not lend itself to testing in a randomized format. Conversely, low quality or contradictory Class I data may not be able to support a Level I recommendation.

Level II: The recommendation is reasonably justifiable by available scientific evidence and strongly supported by expert opinion. This recommendation is usually supported by Class II data or a preponderance of Class III evidence.

Level III: The recommendation is supported by available data but adequate scientific evidence is lacking. This recommendation is generally supported by Class III data. This type of recommendation is useful for educational purposes and in guiding future clinical research.

Classification Scheme:

Class I: Prospective, Randomized, Double-Blinded Study

Class II: Prospective, Randomized, Non-Blinded Trial

Class III: Retrospective Analysis of Patient Series

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

Lower Extremity Venous Injuries

Conclusions were based on evidence obtained from prospective, randomly assigned, double-blinded studies (Class I); prospective, randomly assigned, non-blinded studies (Class II); or retrospective series of patients or meta-analysis (Class III). The evidentiary tables included no Class I references, one Class II reference, and thirteen Class III references.

The type of supporting evidence is identified and graded for each recommendation (see "Major Recommendations").

Lower Extremity Arterial Injuries

Conclusions were based on evidence obtained from prospective, randomly assigned, double-blinded studies (Class I); prospective, randomly assigned, non-blinded studies (Class II); or retrospective series of patients or meta-analysis (Class III). The evidentiary tables included no Class I references, nine Class II references, and twenty-seven Class III references.

The type of supporting evidence is identified and graded for each recommendation (see "Major Recommendations").

Combined Arterial and Skeletal Extremity Injury

Conclusions were based on evidence obtained from prospective, randomly assigned, double-blinded studies (Class I); prospective, randomly assigned, non-blinded studies (Class II); or retrospective series of patients or meta-analysis (Class III). The evidentiary tables included no Class I references, no Class II references, and eleven Class III references.

The type of supporting evidence is identified and graded for each recommendation (see "Major Recommendations").

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Appropriate management and evaluation of lower extremity venous, arterial, and skeletal injuries from penetrating trauma

POTENTIAL HARMS

Repair of lower extremity venous, arterial, and skeletal injuries has led to the following reported complications:

- Vascular thrombosis
- Extremity edema
- Gangrene
- Need for extremity amputation
- Graft infection

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

The guideline developers make the following recommendations regarding implementation:

Implementation involves extensive education and inservicing of nursing, resident, and attending staff members and has one important guiding principle: the guidelines must be available to the clinicians in real time while they are actually seeing the patient. The two most common ways to apply these are by using either a critical pathway or a clinical management protocol. A critical pathway is a calendar of expected events that has been found to be very useful within designated diagnosis-related groups. In trauma, where there are multiple diagnosis-related groups used for one patient, pathways have not been found to be easily applied with the exception of isolated injuries. Clinical management protocols, on the other hand, are annotated algorithms that answer the "if, then" decision making problems and have been found to be easily applied to problem-, process-, or disease-related topics. The clinical management protocol consists of an introduction, an annotated algorithm and a reference page. The algorithm is a series of "if, then" decision making processes. There is a defined entry point followed by a clinical judgment and/or assessment, followed by actions, which are then followed by outcomes and/or endpoints. The advantages of algorithms are that they convey the scope of the guideline, while at the same time organize the decision making process in a user-friendly fashion. The algorithms themselves are systems of classification and identification that should summarize the recommendations contained within a guideline. It is felt that in the trauma and critical care setting, clinical management protocols may be more easily applied than critical pathways, however, either is acceptable provided that the formulated guidelines are followed. After appropriate inservicing, a pretest of the planned guideline should be performed on a limited patient population in the clinical setting. This will serve to identify potential pitfalls. The pretest should include written documentation of experiences with the protocol, observation, and suggestions. Additionally, the guidelines will be forwarded to the chairpersons of the multi-institutional trials committees of the Eastern Association for the Surgery of Trauma, the Western Association for the Surgery of Trauma, and the American Association for the Surgery of Trauma. Appropriate guidelines can then be potentially selected for multi-institutional study. This process will facilitate the development of user friendly pathways or protocols as well as evaluation of the particular guidelines in an outcome based fashion.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better

IOM DOMAIN

Effectiveness
Timeliness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

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ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1999

GUIDELINE DEVELOPER(S)

Eastern Association for the Surgery of Trauma - Professional Association

SOURCE(S) OF FUNDING

Eastern Association for the Surgery of Trauma (EAST)

GUIDELINE COMMITTEE

Eastern Association for the Surgery of Trauma (EAST) Practice Management Guidelines Work Group

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Eastern Association of Penetrating Trauma (EAST) Practice Parameter Workgroup for Penetrating Lower Extremity Trauma: Abenamar Arrillaga, MD; Kimberly Nagy, MD; Eric R. Frykberg, MD; Raymond Bynoe, MD

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

An update is not in progress at this time.

GUIDELINE AVAILABILITY

Electronic copies: Available (in PDF format) from the [Eastern Association for the Surgery of Trauma Web site](#).

Print copies: Available from the EAST Guidelines, c/o Fred A. Luchette, MD, Loyola University Medical Center, Department of Surgery Bldg. 110-3276, 2160 S. First Avenue, Maywood, IL 60153; Phone: (708) 327-2680; E-mail: fluchet@lumc.edu.

AVAILABILITY OF COMPANION DOCUMENTS

The following is available:

- Eastern Association for the Surgery of Trauma (EAST) Ad Hoc Committee on Practice Management Guideline Development. Utilizing evidence based outcome measures to develop practice management guidelines: a primer. Allentown (PA): EAST, 2000. 18 p.

Electronic copies are available (in PDF format) from the [EAST Web site](#).

Print copies: Available from the EAST Guidelines, c/o Fred A. Luchette, MD, Loyola University Medical Center, Department of Surgery Bldg. 110-3276, 2160 S. First Avenue, Maywood, IL 60153; Phone: (708) 327-2680; E-mail: fluchet@lumc.edu.

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on September 17, 2001. The information was verified by the guideline developer on September 27, 2001.

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